Appendix D

Evolution and Breakthrough

Table V offers another view of the IT future that the panel constructed. It is a view of the 10-30 year future composed of:

1. "Evolutionary successes" with high probability of being achieved
2. "Breakthrough possibilities" with low probability but revolutionary impact
3. "Issues" as technological, educational, and organizational concerns for the future of the Air Force in the era of the information revolution.

Through a complex process of proposing and voting, the panel created a list of 55 candidates, and narrowed it down to the list of 19 that are shown in Table V. Though the panel used this list to stimulate its own thinking, it saw this list as possibly of use to others.

Table V Evolutionary Successes; Breakthrough Possibilities; Issues

Evolutionary Successes:

- Smart materials: Materials will change shape, color, texture, etc., to fit different situations.
- Human-Computer Interaction will be based on interpretations of multi-modal signals. We will interface with our computers through speech, hand gestures, eye movement, etc., imitating some of the ways in which we communicate with other humans.
- Telepresence: What we do as humans will be transferred to other things, bigger or smaller. Telepresence acts for humans under human control remotely.
- Virtual pilot, virtual crew: One or more of an aircraft crew will be replaced by software on-board or by crew members operating remotely.
- Widespread use of COTS (Commercial-Off-The-Shelf): Air Force will outsource functions, use commercial services and products, integrating them with Air Force systems (versus internally building or providing functions).
- Data broadcast satellite: Like broadcast TV, large amounts of data will be broadcast to a wide audience.
- Continuous speech understanding: Dictation transcription, query interpretation, and other natural language understanding tasks will be handled with broad scope (not limited domains as at present).
- Logistics/acquisition: Computer-enabled "smart" equipment embedded in equipment will automatically track status, do diagnostics, maintain maintenance records, and assist maintenance.

- Data fusion: Many different sources of information, some being sensor data, some being symbolic knowledge, will be fused together into accurate situation models, assisting situation awareness.
- MEMS, micro-electromechanical systems: Electromechanical systems on inexpensive microships will perform a wide variety of sensor and effector functions.

Breakthrough Possibilities:

- High density memory: We will increase our ability to store large amounts of data in small volume (very high "bit density") by many orders of magnitude using optical and holographic methods and perhaps by storing directly into molecules.
- I/O Processing: Most of "computing" will be the handling of inputs and outputs, e.g., video and sensor data.
- Thoughts to electric patterns: Sufficient correlation will be made between patterns of thinking and intended human action such that an input channel from human mental activity to computer can be fashioned (bypassing muscle action, speech, etc.).

Issues:

- Organization designed for information exploitation: Information will be an organization's most critical resource, after personnel.
- Graceful degradation: Technology that fails will automatically reconfigures itself from redundant functionality (that is, as humans did on the Apollo 13 mission).
- Info-centric aircraft: Aircraft will be designed to maximize information processing potential (in contrast to 20th Century aircraft design that optimized aerodynamic, not information, performance)
- Architecture: Information systems will have a clear architecture in terms of design rules, interface standards, etc. and there will be families of systems with the same architecture (saving money and system-building time).
- Infowar: Who is the enemy? What are his capabilities? Is the threat economic, terror, war? Who defends/monitors cyberspace?
- Security in openness—the so-called "spotlight weapon": Can we use our intelligence information in a more open way to carry out a "CNN-type" mission in which the pressure of nations and populaces are used to bring about a desired end (in lieu of either diplomacy or projected force)?